X-ray Diffraction Microscopy at SPring-8

Yoshinori Nishino[1], Yukio Takahashi[1], Yoshiki Kohmura[1], Hisashi Naitow[1], Masaki Yamamoto[1], Hidenori Toyokawa[2], Eiichiro Matsubara[3], Kazuhiro Maeshima[4], Naoko Imamoto[4], Masayoshi Nakasako[5], Hidekazu Mimura[6], Satoshi Matsuyama[6], Hirokatsu Yumoto[6], Keiko Katagishi[6], Soichiro Handa[6], Akihiko Shibatani[6], Kazuto Yamauchi[6], and Tetsuya Ishikawa[1]

[1]RIKEN SPring-8 Center, [2]SPring-8/JASRI, [3]Kyoto University, [4]RIKEN DRI, [5]Keio University, [6]Osaka University

We report various recent activities on x-ray diffraction microscopy at SPring-8. In materials science applications, we are especially interested in mesoscopic size structure in metallic materials, which often controls important functions in practical aspects. As an example, we present a 3D visualization of a sub-micron size precipitate in an Aluminum alloy particle. Such structure is difficult to observe non-destructively in other methods. In biological applications, we are pursuing visualization of organelles, and we have started measurements of chromosomes. In parallel with application works, hardware improvements have been made. Recently, a new function was added to our microscope instrument to largely change the sample-to-detector distance for measurement of various size samples at various x-ray energies.

At SPring-8, the construction of VUV free electron laser (FEL) has completed, and they succeeded in laser amplification at a wavelength of 49 nm. In addition, the construction of Japanese x-ray FEL has started last year. We have begun studies toward the use of x-ray FEL for diffraction microscopy. In order to make maximum use of coherent x-rays of FEL, x-ray focusing optics is essential. We consider that a total reflection mirror is a good candidate for it because of its radiation hardness. Preliminary studies of diffraction microscopy with mirror focused x-rays have started. We also show simulation results for a biological molecule in a very simple case of neglecting radiation damages, and some discussion regarding imaging detectors will be given.